





Huawei Technologies

# COMMUNICATE

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*Beyond Technology*

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Huawei Telco OS

Walking the road to  
cloud transformation

Score a transformation  
win with managed IT services



**Going digital by  
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# The ROADS to digitization

Heinrich Hertz probably didn't know that discovering electromagnetic waves in his Berlin lab more than a century ago would change the world. His work was the ancestor to telecommunications, which in turn birthed the informatization of today's earth.

With the breakneck development of mobile Internet, cloud computing, big data, and IoT, our connectivity-based digital ecosystem is now universal. And at its zenith sits the cloud. In all fields of human endeavor, offline activities are shifting online, leading to a digital realm that transcends space and time.

Companies must adapt. Why? Because the bottom-line for users is a better digital experience or, as Huawei puts it, ROADS – Real-time, On-demand, All-online, DIY and Social. This is the new standard for people to receive and carriers to give.

User experience is the key to Internet services. A superior user experience can generate significant premiums – even a 1 percent improvement can multiply the value of networks many times. From voice to data, carriers are expanding their portfolios. Traditionally, 80 percent of their revenues derived from 20 percent of services and users. In the digital era, this 80 percent now results from 60 percent of their services and users.

Services in the digital era are diversifying and fragmenting, and their lifecycles are shortening. To adapt to this brave new world of services, carriers must speed up service TTM, minimize trial-and-error costs, open up network capabilities, and build industry ecosystems. In this sense, digital transformation is a must.

The essence of digital transformation is combining the traditional telecom industry with the Internet to achieve agility and trial-and-error at low cost. Digital transformation requires carriers to reconstruct traditional production and operations systems, business processes, and organizations. A flexible and scalable network, an open and mutually beneficial ecosystem, a dynamic and responsive operations system, an efficient flat organization – these are the hallmarks of an open, flexible business system that can increase revenues, reduce OPEX, and achieve business agility.

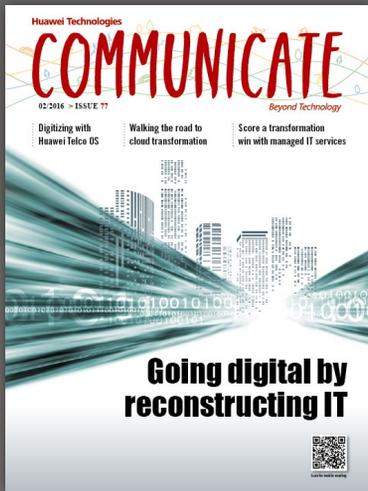
As a long-term partner of more than 400 carriers across the planet, Huawei knows what challenges and issues carriers face when it comes to digital transformation. We entered the cloud computing arena back in 2008. Now, we staff five cloud computing R&D centers with over 10,000 researchers and partner with 15,000 enterprises globally in various industries to build a digital ecosystem together. To help customer move with more agility, we must be agile ourselves. Huawei is working on the Three Clouds Scheme: Experience, Knowledge, and Customer Solutions. This is the way we are digitizing and executing ROADS.

Sun Tzu said, "All conditions are favorable". That is true right now. As we stand on the crest of the digital wave, Huawei stands shoulder-to-shoulder with all industry players and carriers. Together, we will connect the future.



**Zou Zhilei**  
President of Carrier Business  
Group, Huawei

Zou Zhilei



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Annual Supplier Awards

**London, UK, February 1, 2016,** Vodafone honored Huawei twice at its Annual Supplier Awards. The first award was for Huawei's contribution to Project Spring in 2015, and the second award recognized 10 years of partnership between Vodafone and Huawei. Huawei received the award for Extraordinary Contribution to Project Spring for the second consecutive year.

**Orlando, US, February 2, 2016,** The annual conference of the global Association for Passive Optical LAN (APOLAN) opened in Orlando, bringing together 32 enterprise members and the media. Huawei officially became an APOLAN member at this year's meeting.

APOLAN

10 Million

<< Statistics



**London, UK, January 28, 2016,** Huawei announced its partnership with Denmark's largest multi-service operator, TDC Group (Tele Danmark Communications). Huawei will be upgrading TDC's coaxial network to deliver broadband speeds of up to 1 Gbps.

The project will start this summer, with completion scheduled for the end of 2017.



1Gpbs

**Shenzhen, China, February 3, 2016,** Shipments of Huawei P8 Lite smartphones hit 10 million units, marking a milestone that was reached in just nine months after the phone's launch in Europe last spring. In total, P8 series phones are in the hands of 16 million people across the globe.

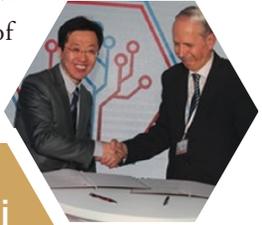
Ecosystem >>

European Academic Salon



London, UK, February 12, 2016, A total of 50 academics, policymakers, and industry leaders from across Europe gathered together at Huawei's first-ever European Academic Salon at the Royal Academy of Engineering in London. Discussions focused on the future direction of innovation, and how universities and businesses can work together.

Shenzhen, China, February 3, 2016, Huawei and Poznan Supercomputing and Networking Center (PSNC) in Poland officially inaugurated the PSNC-Huawei Innovation Center. The center will facilitate joint research in the areas of high-performance computing, cloud storage, and big data.



PSNC-Huawei Innovation Center

Holistic ICT CEM Solution

Shenzhen, China, February 5, 2016, Huawei announced its partnership with Dynatrace, a global leader in digital performance management. The partners plan to innovate and develop the first holistic solution for ICT Customer Experience Management (CEM). The project will help evolve experience management in the telecommunications CEM industry from network-based to integrated service-based spanning the full-customer lifecycle.

Shenzhen, China, January 25, 2016, Huawei successfully launched the fourth CEM Elite Club as the main sponsor of IQPC CEM at Telecoms Global Summit 2016 in Park Plaza Victoria, London. IQPC CEM at the Telecoms Global Summit is the world's leading forum covering CEM, attracting C-level executives from operators across the globe.

Lean GSM Solution

Shenzhen, China, February 2, 2016, Telenor India announced that it has largely commercialized Huawei's Lean GSM solution, paving the way for mobile broadband (MBB) transformation. The solution has been deployed in 28 cities, including Ahmedabad, Lucknow, and Varanasi. Designed to enhance coverage and boost spectral efficiency, the deployment of Huawei's Lean GSM modernized and future-proofed 5,000 sites in a record 90 days.



CEM Elite Club

<< Cutting Edge Technology

# Going digital by reconstructing IT



**Zheng Chunhua**  
President of Marketing,  
Carrier Business Group, Huawei

In the digital era, operators need to provide a ROADS experience (Real-time, On-demand, All-online, DIY and Social). They can only do so by restructuring their IT systems from internal support systems into value creation systems.



**T**he last few decades have seen great progress, with IT transforming the way we communicate, learn, shop, travel, and socialize. We now stand at the forefront of a new digital realm where people can roam unshackled by time and place, which will continue to grow as more people and things get connected. In the working world, industries will digitize, and business, R&D, production and sales models will completely change.



## **New revenues for operators**

While telecom networks drive the information era forward, the digital dividends from user growth are declining. Mobile penetration is approaching saturation, user demand is forcing operators to upgrade their networks, and OTT apps are cannibalizing core services. These factors are decelerating operators' previously rapid growth and shutting down the digital dividend revenue stream. What's the answer? Huawei believes it exists in different stages of physical-digital integration, with each stage offering operators different revenue sources.

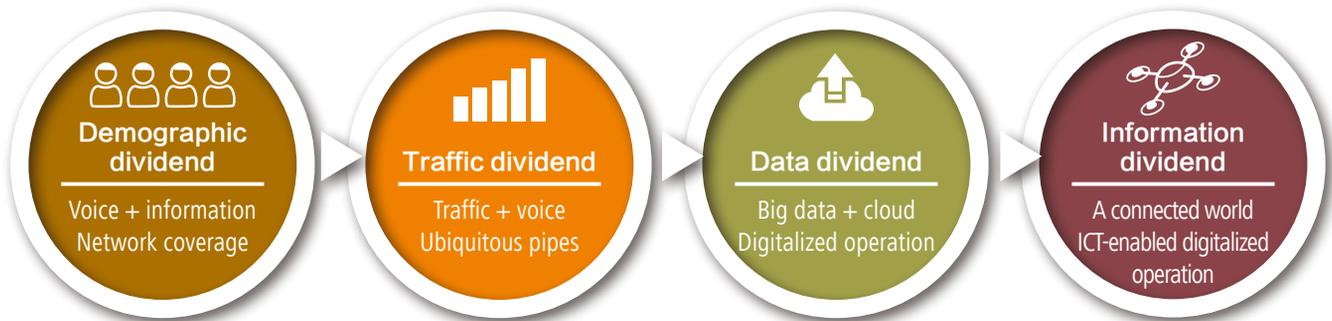
**Demographic dividend:** the earliest stage where the first networks enabled long-distance communication and fulfilled basic communication needs.

**Traffic dividend:** the current stage of bandwidth expansion where people's traffic demands are increasing, content is changing from voice and text to images and video, and channels are shifting from broadcast to on-demand and customized. The next five years will see mobile broadband subscribers jump to up to 4 billion and bandwidth demand soar by up to fivefold.

**Data dividend:** the stage where cloud computing and big data surge, leading to diverse services and moving all kinds of sectors online. Enterprises' internal IT applications will migrate to the cloud, and centralized supply will enlarge the corporate market.

**Information dividend:** the stage where the digital world eclipses the physical world in size, prompting new discoveries and unlimited possibilities. Huawei predicts there will be 100 billion connections by 2025.

## **Transforming operators' IT systems**



*User experience must be ROADS: Real-time, On-demand, All-online, DIY and Social. ROADS requires operators to restructure their IT from internal support systems to value creation systems.*

To effectively mine data and information dividends, operators must transform from asset-heavy beasts into agile, efficient vectors that can quickly adapt to changes in external demands and *internetize* user experience.

User experience must be ROADS: Real-time, On-demand, All-online, DIY and Social. ROADS requires operators to restructure their IT from internal support systems to value-creation systems. What does this require?

**Cloudification and software-defined infrastructure**

Cloud computing is initiating ICT convergence, and represents the next key growth point for operators. IT infrastructure will continue to cloudify, greatly improving infrastructure resource use and efficiency. Software-defined telecom networks will emerge

on the back of software-defined networking (SDN) and network function virtualization (NFV). New service TTM will drop, and ROADS capabilities on the upper layer will sprint with new agility. At this time, more than half of companies will entrust no less than 50 percent of their IT assets to third-party (3P) data centers, and cloud service providers will provide 60 percent of all storage capacity.

Local branding and resources give operators the edge over multinational cloud companies, and cloud services provided for customers on platforms housing cloud telecom infrastructure will give them revenue.

Huawei is one of the first players to start building cloud data center solutions featuring open, distributed cloud architecture and IT infrastructure platforms. As of June 2015, we had built more than 660 data centers for customers across the world, including 225 cloud data centers, and more than 700,000 virtual machines.

**Next-gen operating systems (OS) for ROADS**

To empower carriers' business, the next-gen OS must be able to handle resources, services,

and management. Our vision of what we call Telco OS comprises three core modules:

**Infrastructure Enabler System (IES):** flexibly schedules bottom-layer ICT infrastructure.

**Big Data Module:** enables operators to mine massive amounts of user data, recreate user service scenarios, generate high-value service policies, and optimize operations.

**Business Enabling System (BES):** allows users to develop products and services by providing an agile interface for designing plans, developing partners, and facilitating user service subscriptions.

Huawei is currently developing the Telco OS, and has already deployed BES and Big Data Modules.

### **Open, aggregated digital platforms**

Carriers must help advance the digital realm by building open service platforms and digital ecosystems for society. They need to aggregate innovations and content to become digital platforms that merge the physical and digital realms.

To support carriers, Huawei has designed Digital inCloud, a solution that offers a unified open platform and alliance. Digital inCloud opens telecom resources to partners for quick and easy selection and use. This alliance transforms networks from closed service environments to open digital ecosystems that connect partners and resources, helping operators quickly aggregate partners and provide diverse service content.

### **Beyond connectivity**

With cloudified infrastructure, ROADS-capable OS, and open digital platforms, operators can provide high-quality connectivity and cloud services for individuals and

enterprises. They can attract players from different sectors and 3P developers to join their ecosystems, develop apps for different vertical industries and market segments, and cultivate user-oriented long-tail markets.

Huawei already provides public cloud services. We are expert at cloud system O&M, and have helped operators expand into cloud service markets by providing system integration solutions that enable vertical integration.

## **Going fully digital**

Telecom digitization has begun, and more operators are transforming. Huawei began deploying resources in a mainly private cloud back in 2008. In 2010, we formally entered the cloud market with our Cloud Plan, later expanding into the market with a range of solutions developed from our vast research strength. In 2012, Huawei proposed SoftCOM, a full transformation solution covering architecture, network, operations, and services.

Huawei understands that transformation is an integrated systems project where products alone will not suffice and services are crucial. Our stance has shifted from product-driven, service support to growth driven by both products and services. Customers can transform more easily with Huawei's one-stop software and hardware solution — products, consulting, planning, integration, and support.

The telecom industry faces a long road towards digital transformation, presenting a great challenge for both operators and equipment providers. As a long-term partner, Huawei will walk shoulder-to-shoulder with its customers on the path towards digital transformation and a Better Connected World. 

# Digitizing with Huawei Telco OS



**Dr. Sun Dong**  
Chief Architect of Digital  
Transformation Solutions,  
Huawei

Huawei's Telco OS, a next-gen digital operations system, is the figurative space shuttle for operators' digital transformation journey. Deployment takes place top-down to kick user experience up a notch, build core competence through strategic planning, and enable business innovation.

**D**igital operators aren't just about providing digital communications services. As builders of new, integrated digital ecosystems, they are in fact enablers of the digital economy in multiple contexts, including mobile, cloud, big data, IoT, and social.

Our brave new internetized and digitized world means that operators can no longer rely on fixed, pre-defined products as killer applications.

Because customer requirements continually change, they need to start running flexible business models that provide everything as a service.

Such a model must cater for long-tail applications and customized services, and meet customer requirements ROADS-style. EaaS can

## Everything-as-a-Service (EaaS)

be furnished by smart pipelines, digital service enablement, Open Digital Ecosystem Enabler (ODEE), or a mixture of several models.

## Building it the digital way

Changes in end-user behavior patterns and experience requirements have triggered a need for total, end-to-end (E2E) digital transformation that spans new operations models and personnel.

Digital transformation requires operators to formulate top-down digital enterprise architecture in three steps: plan at the company level, create new business models, and implement new processes and technical infrastructure.

Under a governance model, the enterprise architecture built by digital operators is set to include strategic objectives and business models. Breathing life into both will be implementation architecture for applications, services, tech, and information. The digital enterprise architecture of telecom operators is abstracted as Three, Two, One.

### Three strategic objectives

- ROADS user experience for consumers, enterprises, partners, and O&M personnel.
- Open Digital Ecosystem Enabler for transformation from traditional communications service providers to digital ecosystem enablers.
- Agile digital operations using IT technology to transform traditional support systems into business enablement and production systems.

### Two platforms

- Cloud OS: a cloud-based, virtual platform. Tech like NFV, SDN, and vDC will cloudify and virtualize infrastructure capabilities.
- Telco OS: a digital operations enablement

*As a business enablement and production system, Telco OS is the brain and central nervous system of digital enterprise architecture – it is the orchestrator, manager, decision-maker, and monitor of executive capabilities.*

platform for business and agile operations. This OS will provide IT backend capabilities such as BSS, OSS, SDP, and big data.

### One ecosystem

- An open digital ecosystem for building an industry alliance for the digital economy.

Operators need to retire their current business models and then implement an EaaS model that's geared towards long-tail applications and customization.

Current models are predefined, long-cycle, packaged, and offline teller-style. The EaaS model is a quick, on-demand, and customized online digital model that suits speedy trial and error, iterative development, and integrated digital operations that leap with agility.

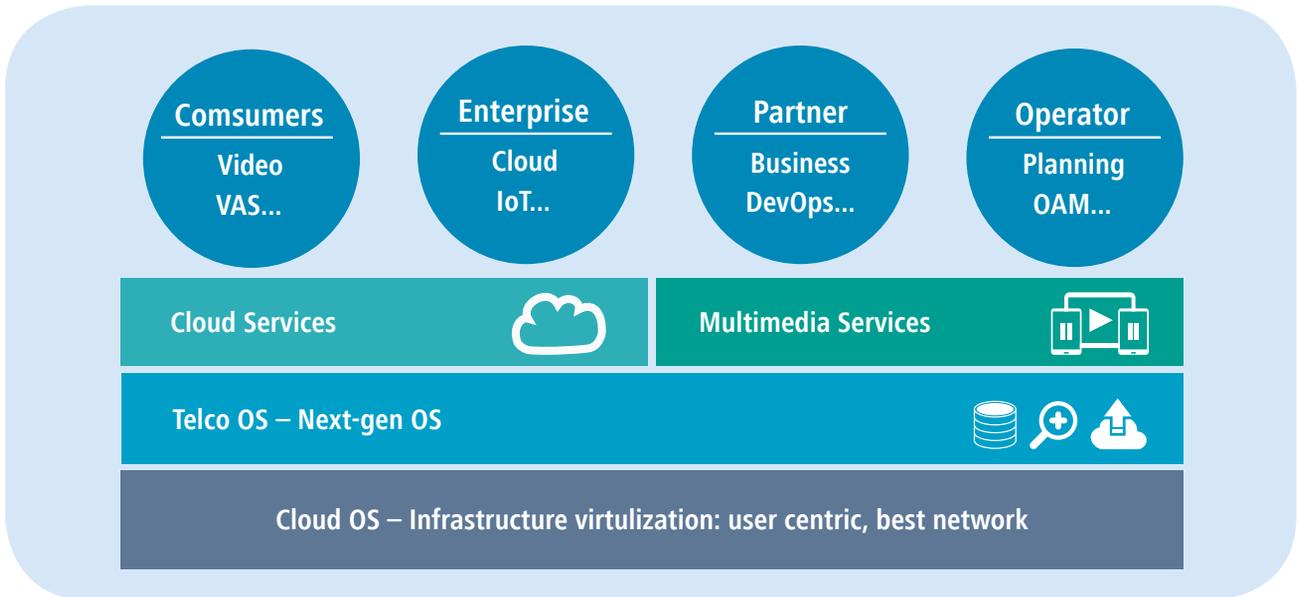
These core requirements feature in Huawei's Telco OS. Telco OS orchestrates user requirements, business processes, and end-to-end resource scheduling and allocation to transform what users want into services and products.

As a business enablement and production system, Telco OS is the brain and central nervous system of digital enterprise architecture – it is the orchestrator, manager, decision-maker, and monitor of executive capabilities.

## Telco OS architecture

Telco OS contains three systems: Business Enabling System (BES), Infrastructure Enabling

## Open Ecosystem



Blueprint for implementing digital enterprise architecture

*Big data capability is the system's brain for smart operations. Network-wide big data analysis boosts user experience and enables real-time, on-demand, and agile operations.*

System (IES) and Big Data.

### BES: Enabling business agility

The BES covers all the capabilities of the BSS, and provides much more besides:

- Offers diverse product classifications and management methods.
- Simplifies and automates business processes.
- Optimizes user experience.
- Applies a flexible partner business model.
- Uses the latest cloud technology to provide flexible, elastic, and scalable capacity.
- Enables fast, efficient, and cost-effective

deployment.

### Big data, big brain

Big data capability is the system's brain for smart operations. Network-wide big data analysis boosts user experience and enables real-time, on-demand, and agile operations.

- Collects data on network, services, and users in real time.
- Analyzes and correlates applications in real time so data becomes useful.
- Follows and automatically triggers processes.
- Makes decisions in real time.

### IES: Automating ICT infrastructure

IES is an enablement system for automating O&M in ICT infrastructure. It comprises SDN, NFV, and the whole cloud infrastructure.

ICT infrastructure automation is highly complex because many different types of equipment and processes are in play. So,

automating and integrating O&M E2E is based on policy configuration and business templates that define use case processes and lifecycle management.

- ICT-Orchestration (ICT-O): unifies, orchestrates, and schedules resources for rapid business innovation and service provisioning in real-time.
- ICT-Assurance (ICT-A): provides a network-wide, full-service assurance service that supports intelligent and efficient network-wide monitoring, fault location, and network optimization.

The operations of IES are policy-based: ICT-O carries out ICT resource provisioning and application deployment based on policies. In this case, service design personnel specify the deployment policies of each network service for the ICT-O to follow when determining and deploying resources.

ICT-A then coordinates with ICT-O. ICT-A monitors and analyzes services in real time. Based on the policies that are set, the system triggers the ICT-O to troubleshoot and optimize the network.

How is Telco OS deployed?

Top-down in three steps:

### **Step 1: Define the specs for digital enterprise architecture.**

- Build core platform capabilities, with E2E orchestration as priority one. Modularize, atomize, and servitize back-end functions (BSS/OSS).
- Enable support for real-time, online user experience and large-volume and concurrent user transactions online.
- Remodel the business model and business processes as follows: user demand for customization, support for real-time

intelligent decision-making and dynamic orchestration capabilities (sales, service, operations, and platform), on-demand closed-loop business, resources, and big data.

### **Step 2: Make the solution business-driven and pioneer business initiatives**

Build capabilities in line with business scenarios to make operations business-driven. Prioritize business enablement and operating capabilities. Enable governance on big data network-wide to enable digital operations.

- Position new services, new users, and new systems like cloud services and IoT as starting points.
- Transform traditional business and systems, upgrade systems to shorten ROI, and gradually phase out traditional business models.

### **Step 3: Perform iterative development and operations**

- Apply the integrated approach of DevOps to build platform capabilities based on service requirements and gradually strengthen capabilities.
- Digital transformation is a long-term process. Operators need to keep in mind that their overarching goal is to meet user demand and build capabilities upon strategic planning and service innovation.

As an operations enabling system for digital transformation, Telco OS helps operators and traditional businesses by providing core capabilities for full digital transformation, entry to the digital economy, and a ROADS experience. 



# Walking the road to cloud transformation

Operators need to transform to escape stagnant growth in a saturated market. To achieve this, they must build IT-based networks on a standardized, flexible infrastructure platform. With mature cloud computing and high-performance x86 servers, cloudified data centers are without doubt the best way to go.



**Li Ke**  
Marketing Director, Data Center, Huawei

## Saturation threatens growth

Once a status symbol for a privileged few, mobile phones are now the rule, not the exception. In economically developed regions like Europe and the Middle East,

penetration rates surpass 100 percent, and worldwide the total number of mobile users is approaching the global population of 7.25 billion. With traditional telecom services facing this level of market saturation, carriers are finding it hard to grow.

Meanwhile, Internet services like real-time chat apps have skyrocketed

and muscled in on operators' traditional territory. In 2014 alone, one Chinese carrier saw its profits from SMS, its most profitable service, plummet by 20 percent.

Facing a bleak outlook, external competition, and internal complications, carriers must transform to combat these threats.

## Where do we go from here?

The Internet model has succeeded, and can give operators some major pointers. First, we have the Internet's diversity of services for sectors ranging from transportation, entertainment, and socializing, to retail, and finance.

Then there's the Internet's cloud-based infrastructure and universal, standardized IT hardware, which enables rapid service innovation, minimizes costs, and allows easy scalability and capacity expansion. This advanced model of architecture is one of the key reasons why the Internet has grown so quickly.

In contrast, carriers are still lumbered with rigid, siloed IT architecture. Service updates come at a snail's pace, and single services such as voice, SMS, and broadband pale in comparison to the diverse and varied services offered by the Internet.

To transform and escape stagnant growth in a saturated market, operators need to build IT-based networks on standard and flexible infrastructure. With cloud computing and high-performance x86 servers becoming mature, cloudified data centers are without doubt the best way for operators to do this. They can provide a firm foundation for carriers to develop digitized services, implement ICT integration, and rapidly deploy new services. Networks can be expanded more flexibly, and operating efficiency greatly increased.

## Huawei's cloud data center solution

We believe IT-based networks are the future. All control and service layers on this kind of network will be software-based and run on cloud data centers outfitted with general-purpose x86 servers. Future networks will be built on data centers, making agile, efficient, and open cloud data centers a key requirement for ICT transformation for operators.

Huawei's cloud data center solution is based on Huawei's service-driven distributed cloud data center SD-DC<sup>2</sup>. At the core of SD-DC<sup>2</sup> lies the OpenStack framework-based FusionSphere cloud OS. Huawei's solution transforms IT infrastructure including servers, storage and networks into standardized, shared cloud resource pools.

By cloudifying the VAS operators provide, the BSS enables elastic resource scalability and automatic service deployment. Not only does this improve resource utilization and reduce OPEX, it also helps operators provide services such as public clouds and generate new business.

New services can be deployed via the network management system interface based on automation and process orchestration technologies. Hardware, middleware, operating systems, and applications can be installed with a mouse-click.

As a result, new services can go online in days, enabling operators to rapidly respond to business needs and market changes.

## Phased transformation

Due to the extreme complexity of operator network structures and

the variety of different hardware and software, cloudification is a long-term process. Initially, operators will cloudify periphery and simple services before moving on to core and complex services.

They will be able to build unified and flexible IT resource pools by rebuilding internal data centers and using highly versatile and low-cost cloud computing software and hardware platforms. They can then cloudify and migrate upper-layer IT services and systems such as BSS, OSS, and VAS to reduce OPEX and increase service efficiency.

Many of the world's leading operators, including China's big three, have already adopted this strategy. China Mobile's 2+N data center building strategy, for example, aims to meet long-term growth requirements. It calls for constructing two modern, world-class data centers – China Mobile International Information Port and Southern Base – and involves concurrently building province-level data centers in major provinces.

Operators will also need to use their existing fixed assets, including telecommunications networks, data centers, and large consumer and enterprise user bases; develop IaaS and SaaS public clouds; find new revenue sources; and successfully transform into ICT service providers.

Growth is stagnant for operators; but, if they deploy Huawei's solutions, they can transform and unlock the great potential that the connected world of the future holds. 



## Platform, Partners, Processes Moving from CSPs to DSPs with Digital inCloud

Digitization is here and it's happening. In response, Huawei's Digital inCloud is designed to transform carriers from communication service providers (CSPs) into digital service providers (DSPs). It does so by virtue of the 3Ps: platform, partners and processes.



**Amarendra Kumar Singh**  
Vice President of Managed Services Dept., Huawei

The increasing demand for embedding new digital technologies in services has already transformed many industries, including media and entertainment, financial services, retail, healthcare, and utilities. Management teams have identified that digital technologies lower OPEX and improve customer experience, leading to rapid growth.

In contrast, the industry that provides the backbone to this process is slow to respond to the new ways of working in the digital era. However, it's predicted that by 2025, there will be a big jump in numbers, with 6.5 billion Internet users, 8 billion smart phones, and more than 100 billion connections. A total of 80 percent of users will access the Internet via

their mobile phones. Notably, Internet users are increasingly using smartphones to access content, socialize, buy things, and work, putting operators in a very enviable position.

## From CSP to DSP

In this new era, CSPs are striving to take the front seat in industry digitization, but the ecosystem is being disrupted by third party OTT players. They are bypassing the traditional CSP model and becoming hugely popular with subscribers. This in turn has heaped pressure on the business models of CSPs, pushing them to become bit-pipe players rather than digital enablers. It is now more important than ever for CSPs to reinvent themselves as DSPs and offer better and improved experiences for customers.

To achieve this, carriers must focus on the following:

**Digital services:** Innovation is the key. DSPs must offer fast and diverse digital services such as data, video, and enterprise services.

**Building digital ecosystem:** The larger the scale, the better. DSPs should build a value chain alliance to enable all players to succeed.

**Enabling digital operations:** Keep it simple yet effective, and use big data solutions to enable digital businesses, and transform traditional support systems.

**User experience improvement:** Provide a smart experience for users – a Real-time, On-demand, and All-online service experience.

To successfully transform, CSPs will need to focus on three key areas: platforms, partners and processes.

## Digital inCloud: Powering CSP transformation

Huawei, with its long history of partnerships with CSPs, has rolled out an innovative E2E ICT solution that aims to help CSPs build and monetize their digital ecosystem by exposing the core digital assets to be used in a multi-sided business model.

Huawei Digital inCloud provides a unified open digital platform, aggregates and distributes the ready-to-go digital services and the content of various domains (individual, home, enterprise, and industry) from global players, and implements agile business operations to improve efficiency and reduce OPEX. This solution works by enabling a multi-sided brokerage service that seamlessly connects CSPs on one end and service providers and content partners on the other. It helps both ends enhance their footprint globally – CSPs can serve their subscribers with global content and services, and CP/SPs can attract a wider global subscriber base for their services.

## Puzzling out the Ps

**Platform:** Digital inCloud platform is an on-demand open digital services platform that enables capability opening and service innovation. It allows developers, service partners, and individuals to quickly define, develop, and deploy a range of digital services using service templates and a comprehensive range of E2E business processes. Simplified service creation in this way accelerates time to market (TTM) and enhances the ability of both operators and their partners to innovate and manage a broad range of digital services. With these features, resources, and tools aggregated in one place, partners and developers can quickly assimilate new ideas and technologies.

*The Huawei Digital inCloud solution at the global level offers carrier billing exposure, service distribution channels, big data services for profiling users and prospective subscribers, and the opening of telecom capabilities through simple APIs and cloud services.*

**Partners:** Huawei's Digital inTouch partnership program builds partnership pools locally, regionally, and globally. Currently, the project focuses on seven key areas – TV and video, traffic monetization, mobile games, open API, enterprise, industry, and digital music. The program's goal is to help CSPs build Service Mall to activate their distribution channels.

**Processes:** Huawei Digital Transformation service helps CSPs reduce OPEX and improve customer experience with smarter operations and by improving the integrated processes involved. The operations service framework is cyclical in nature, and comprises the following elements: partner acquisition, product design, promotion plan, operation analysis, customer care, and maintenance. It's based on standard processes that undergo continuous improvement as a result of project experience acquired globally, helping to shorten TTM and reduce OPEX.

## Digital inCloud: Teaming up for more value

**Global telecom capabilities:** accesses and connects to CSPs' network and billing capabilities through open APIs, enabling CPs/SPs to seamlessly integrate their services for easy delivery and monetization.

**Global distribution channels:** global

hosting centers enable the distribution framework of services and content, helping CSPs establish their service malls.

**Global market insight:** Digital inCloud provides market insights to profile subscribers through big data analysis for precision marketing and campaign management for new and existing CP/SPs, greatly boosting their revenue earning capabilities.

**Global payment:** Huawei takes care of global multi-currency payments and settlements on behalf of CPs/SPs and CSPs to smooth out and quicken the process. It removes a major bottleneck in the entire operation process.

**Global cloud service:** Digital inCloud is offered through eight global Hosting Centers strategically located across the globe, eliminating CAPEX requirements for CPs/SPs and making their operations leaner and more efficient.

In 2015, Huawei inTouch aggregated more than 2,100 partners. It offers more than 200,000 services and units of content that reach more than 6 million API transactions per day. By 2019, these numbers will increase to 10,000 partners, and more than 1 million services and units of content will be offered.

In summary, the Huawei Digital inCloud solution at the global level offers carrier billing exposure, service distribution channels, big data services for profiling users and prospective subscribers, and the opening of telecom capabilities through simple APIs and cloud services. At the local and national levels, it offers local market insights, service planning, process optimization, and assistance for business operations.

Digital inCloud helps rapidly increase the value chain, boost business efficiency, accelerate TTM for services, and quickly improve the overall business performance of digital services. 

# Building cloud data centers the smart way

When constructing cloud data centers, operators need strategic partners to assist with top-level design and planning, oversee the quality and progress of construction, and help with cutover and migrating existing services to the cloud.



**Ding Chunming**  
Marketing Manager of Data Center  
Integration Services, Huawei



**You Shungang**  
Chief Architect of Data Center Integration  
Services, Huawei

## Benefits and challenges

Cloudification is set to bring powerful benefits to operators' service systems. The main systems are the vertical systems of telecommunications networks, IT support systems, and IT services.

Cloudification will open and simplify operators' legacy closed and complex networks and VAS, and convert convoluted IT support systems into simple, agile, flexible, automated, and intelligent systems.

Cloudifying customer-facing IT services will help operators shift from selling resources to selling services like cloud services and VAS. After cloudification, the three vertical systems mentioned above will become cloud services. To support them, operators need to adopt unified cloud platforms for service-driven data centers.

They will need to fully assess the impact and requirements of these various cloud services on their IT, networks, and server rooms to ensure data centers can respond to different service scenarios and different stages

in their lifecycles at minimal cost.

Cloud data centers are nothing like traditional data centers. They possess many new features, including COTS hardware, virtualization, distributed storage, and SDN. Therefore, operators face a number of challenges when building cloud data centers:

- Cloudifying IT and CT systems and building future-oriented cloud infrastructure that support ICT service development, despite the complexity of existing network services.
  - Designing cloud data centers to meet the different service requirements of internal and external users while improving efficiency, minimizing costs, and maximizing QoS.
  - Ensuring normal service operations using a large amount of legacy network equipment, multiple vendor brands, and complex service cutover and migration.
  - Managing delivery to ensure progress and quality despite the high quantity of data center subsystems and the complexity of their interfaces.
- Operators need strategic partners to tackle

these challenges by planning the top-level design of their cloud data centers, overseeing construction, and migrating existing services to the cloud. Huawei has extensive experience in primary integration and service migration, having built more than 160 data centers for clients globally.

## Primary integration

Huawei's primary integration service for data centers is service-driven, top-down, and based on a service-to-infrastructure approach. As an integrated and E2E solution, the design centers on modularization, specialization, and standardization. It enables the dynamic matching of infrastructure for service expansion and rapid TTM for new services, while ensuring data center security and reliability.

## Three services:

Huawei's technical consultation service, which is based on leading cloud maturity models and uses industry-standard benchmarks to analyze IT shortcomings in business management, service management,

operations, and infrastructure. It can also draw up IT blueprints and formulate step-by-step, manageable construction plans for customers.

Huawei's cloud network synergy design service is based on the various data center scenario needs of operators, and includes five functions: 1) mapping virtual networks to physical networks, 2) matching IT resource models and network architecture, 3) converting service SLAs and network QoS, 4) unifying the design of data centers' inner and outer networks, 5) balancing security and disaster recovery.

Huawei's primary integration solution can also simulate services and optimize network policies so data center networks can rapidly migrate cloud resources and services, and guarantee high quality for Per Service Per User (PSPU).

Huawei's data center multi-vendor integration service includes solutions based on the seven types of pre-integration and verification scenarios for mainstream vendors, and a mature third-party management system. This service manages progress and risk for customers and ensures final delivery quality.

## Data center consolidation and service migration

Operators need to consolidate their data centers to transition towards the new SD-DC<sup>2</sup> architecture and achieve digital innovation, and simple management at minimal cost.

As the first step toward digitization, Carrier T plans to consolidate its 96 data centers into 6, and migrate most of its OpCo applications to its European headquarters.

With considerable experience in data

center consolidation and migration, Huawei helps operators standardize IT, increase efficiency, optimize costs, and accelerate innovation. Features include quantifiable ROI, clear pace of service cloudification, and smooth and rapid migration.

Huawei's mature construction and migration methodologies fully consider service complexity and uncertainty. These methodologies include implementation plans, rollback schemes, suitable migration paths, and effective operating modes. They eliminate faults due to human error, and migrate whole systems within set timeframes, minimizing service down times.

Huawei's consolidation process includes the following steps:

Match the financial assessment and technical plan through deep analysis, and balance investment, resource utilization, and service continuity to help customers' CIOs or CFOs make the best investment decisions.

Develop a service cloudification roadmap after evaluating factors such as cost and benefits, TTM, compatibility, migration time window.

Analyze service correlation to accurately restore original services, processes and IT infrastructure links; implement data packet grouping based on service correlation complexity and scope of influence; and divide packets into migratable batches based on factors such as resource demands, bandwidth, and equipment reliability. This step minimizes migration risks and ensures service stability.

Huawei's mature management processes also include risk classification, business impact analysis (BIA) models, risk tracking, monitoring, and mitigation systems.

Risk management determines the success of the migration process, which has risks in many areas, including the technical plan, support environment, and resource readiness. A typical support environment risk is insufficient interregional bandwidth, which requires a response plan to be prepared in advance.

When migrating big data applications, the following measures are used to mitigate risks: storage medium backups, manual transfer, and an online incremental data synchronization plan.

## Helping operators build cloud IT infrastructure

Operators' future IT transformation will be based on service-driven data centers, with a strategic focus on consolidating IT and CT and building agile, efficient, and open infrastructure to support business innovation and enablement.

New service-driven data centers and old data center consolidation and migration will help customers greatly lower IT CAPEX and OPEX, accelerate service innovation on SD-DC<sup>2</sup> architecture, reduce service TTM from months to hours, boost management efficiency by up to 50 percent, and increase service availability to 99.999 percent.

As a long-term partner, Huawei is committed to helping operators achieve commercial success. In the area of data center integration, Huawei continues to build primary integration capabilities to provide high-quality, service-driven data center construction and integration services to help operators construct service-driven cloud IT infrastructure. 

# Flying into the public cloud

Alongside an increasingly mature cloud model, the market for public cloud services continues to grow unabated. Public cloud service providers are no longer just targeting Internet companies and SMEs; they also have large corporations and governments in their sights. To meet the needs of major customers, cloud service companies need to provide hybrid cloud services.



**Ma Lijun**  
Senior Marketing Manager, Cloud Computing, Huawei

**T**he global public cloud market was worth US\$112.9 billion in 2015, representing a CAGR of 18.5 percent, according to Gartner's latest report on public cloud services. The largest market is North America at 59 percent, followed by Western Europe at 24 percent. The highest rate of growth, however, can be found in emerging markets like China, India, Latin America, and Russia.

## Leading carriers into the public cloud

The market for public cloud continues to grow unabated, and the cloud service model is maturing. In addition to Internet companies and SMEs, public cloud service providers have large corporations and even government departments in their sights. Indeed, a growing number of major companies and government agencies are choosing to host part or all of their IT systems in the data centers of public cloud service providers.



*So, what about operators? Compared to cloud service providers, carriers have unique advantages in infrastructure, operations, existing users, and existing channels.*

The needs of these kinds of customers can include part or full hosting and a mixture of private and public services, requiring that providers can deliver hybrid cloud services. Hybrid cloud enables companies to deploy their IT systems in different environments and regions, and allows existing and new applications to be identically provisioned. Service departments can fully leverage internal and external universal management and scheduling programs, as well as network connectivity and security models.

The market leader of the public cloud – Amazon (AWS) – was a strong proponent of public cloud until it realized that hybrid is the future. AWS entered the hybrid cloud market in 2013, winning a US\$600 million CIA contract to deploy an isolated cloud service called GovCloud. Other major cloud service providers, including Rackspace, IBM, and VMware, have also introduced hybrid cloud solutions, aiming to build their own differentiated solutions for the enterprise hybrid cloud market.

IBM spent US\$2 billion to acquire data center service provider SoftLayer in the same year AWS won the CIA contract, reflecting a repositioning move away from one-stop IT solutions provider for SMEs to cloud service provider of products, solutions, and services for all sectors. Focusing on large enterprises, IBM's hybrid cloud services combine SoftLayer's cloud service capabilities with IBM's traditional

outsourcing services.

VMware previously positioned itself as an enabler by providing private cloud solutions for enterprises. However, with the public cloud market booming, VMware has also launched public cloud services, focusing on the hybrid cloud. The company aims to build core competency by trading on its leading position in the enterprise cloud market, strength in cloud management tools, and consistent user experience.

So, what about operators? Compared to cloud service providers, carriers have unique advantages in infrastructure, operations, existing users, and existing channels.

First, they own infrastructure such as server rooms, bandwidth and ancillary facilities, and are already hosting the IT equipment of Internet companies. Second, they have mature marketing, technical support and customer services teams and processes. Last, their greatest strength is their huge customer base and viable ways of attracting more customers.

Most operators around the world have started to build public clouds. For example, Deutsche Telekom's T-Systems is expanding its ICT services, focusing on the top 400 multinationals and governments. BT Global Services is eyeing major companies and government ICT services. Orange Business Services is specializing in ICT services for multinationals and major French businesses, and Telefonica kicked off its public cloud project in 2015, concentrating on ICT services for large enterprise customers.

## Getting it right for customers

Operators' key targets for public cloud services are governments and enterprises,

especially large multinationals, which must guarantee high-quality, consistent services in domestic and foreign markets. They need integrated ICT services with strong solutions for computing, storage, networking, security, and O&M. This is where operators' strengths in ICT services can come into play.

Operators' ability to provide scale and reliability can also meet enterprise needs for renting extra public cloud resources and forming hybrid clouds with their own IT resources during busy periods.

## Helping operators grow

Huawei's public cloud data center solution is based on its deep understanding of enterprise customers and long history of end-to-end solutions in the areas of consulting, design, delivery, and operations. The Huawei solution includes several major technical innovations to help operators develop free and convenient public cloud services. These include a large number of service types, one-stop delivery, a PAYU business model, and distributed storage architecture. Huawei has helped dozens of carriers – including China Telecom Global, Indonesia's Telkomsigma and Thailand's True – provide highly competitive public cloud services to SMEs, as well as major government and enterprise customers.

Huawei has already built infrastructure architecture based on OpenStack and SDS, and is exploring the commercialization of SDN with the launch of FusionStorage. Numerous operators have deployed the product in cloud data centers, helping them provide public cloud and hybrid cloud services. With distributed architecture, FusionStorage can lower infrastructure TCO, ensure clear advantages



in data reconstruction and data reliability, and simplify management. Combined with the various security and reliability solutions like VSA, vFW, and vLB in Huawei's cloud computing platform FusionSphere, FusionStorage deploys different applications to meet enterprises' specific needs.

Built on an IaaS solution, Huawei's public cloud solution provides a leasing service for virtual machines in public cloud environments and handles IT outsourcing services. Services include application and service system assessments, professional migration, and system integration.

With the Huawei solution, operators can confidently provide high-grade IT outsourcing services for government and enterprise customers. 



## OSSaaS: The next-gen OSS

OSSaaS is a new kind of OSS business and delivery model. It can be regarded as a next-gen OSS solution – an infrastructure enabling system (IES) that’s perfect for accelerating transformation, and providing CSPs with the range of new skills, processes, and features necessary for OSS transformation.



**Deng Zhengkuang**  
OSS Marketing Director, Huawei

Communications service providers (CSPs) often seek commercial off-the-shelf software (COTS) service packages and support services to outsource operations support systems (OSS). They do so to handle back-end processes such as service fulfillment and assurance for different products, domains, technologies, and customer types.

When no suitable COTS package exists, CSPs can create their own OSS functional

systems for specific business scenarios. OSS can provide a high volume of high-quality operations data, increase operating efficiency, reduce costs, and improve user experience through agility and automation in highly integrated environments.

Software-as-a-Service (SaaS) has grown in popularity around the world, but security and scalability concerns have prevented its widespread use in the telecom industry. Huawei first proposed OSS-as-a-Service (OSSaaS) in

2014 when it developed a deployable OSSaaS solution. At the time, Huawei had already successfully deployed X-as-a-Service in the commercial sector, and the industry was experiencing breakthroughs in access technology, security, hosting technology, analytics, and cloud networks.

Combined, these advancements allow CSPs to transform existing OSS solutions from on-premise deployment to OSSaaS.

## OSSaaS: A new OSS delivery model

OSSaaS is a new OSS business and delivery model. Under long-term contracts, CSPs can obtain a full range of OSS capabilities. OSSaaS comprises three layers: business model, use case, and cloud OSS.

**The business model layer** outlines the potential business value of the Huawei OSS solution, which it defines as improvements to operating efficiency, customer satisfaction, and lower CAPEX and OPEX.

**The use case layer** creates the value defined in the business model layer by identifying different business scenarios to solve pain points. It includes the componentized logic series required by process workflows, and can be used to solve one or more pain points.

**The cloud OSS layer** delivers OSS software capabilities through private, public or hybrid clouds.

The OSSaaS market is still in its infancy, but a growing number of CSPs are actively investigating the potential business benefits of the OSSaaS solution, as well as its cost and efficiency advantages. Leading CSPs are recognizing the commercial value of OSSaaS for multiple reasons:

*OSSaaS is a new OSS business and delivery model. Under long-term contracts, CSPs can obtain a full range of OSS capabilities. OSSaaS comprises three layers: business model, use case, and cloud OSS.*

- **Agile response to new requirements.** The new service-driven model accelerates joint design, the development of new use cases, and meeting new service needs. Huawei applies its large use case library to rapidly satisfying specific customer requirements.
- **Reduction of duplicate investment.** The OSSaaS model enables centralized operations and governance to avoid task duplication. It maximizes synergy by integrating virtual work resources to realize common operating objectives.
- **Predictable investment.** In the last five years, all large CSPs have sought to reduce costs, maximise efficiency, and minimize network upgrade costs and expansion CAPEX. The as-a-Service model can reduce software costs with a multi-year pricing strategy that spreads CAPEX over the network's whole lifecycle, while enabling more flexible network scaling to suit individual deployment scenarios. Studies suggest that OSSaaS can help CSPs reduce costs by 15 percent to 20 percent.
- **Greatly reduced network upgrade cycles.** With the OSSaaS model, software upgrades occur in the server or the cloud, allowing users to upgrade to the latest version in hours or days rather than weeks or months.
- **Rapid and elastic network scaling.** OSSaaS allows CSPs to scale their OSS architecture in the most cost-effective and efficient way

*Huawei's OSSaaS is a centralized solution designed to reduce TCO for CSPs. It provides end-to-end service level management to help improve network performance, and offers a developer environment for CSPs to develop use cases on the OSS platform.*

to the needs of ever-expanding networks.

- **Adaptation to new technology.** CSPs trialing new digital services require new network and OSS functionality to support these services while keeping costs down. OSSaaS enables CSPs to quickly launch new digital services and carry out proof of concept testing (PoC), and, if need be, efficiently scale up operations or fail the service at a minimum cost.
- **Vendor maintained software.** Software is maintained by the developer (vendor), allowing CSPs to access the expertise of the developer's system architects.

## From theory to deployment

Many major operators have deployed OSSaaS worldwide. One leading operator with over 20 OpCos, for example, selected OSSaaS in Service & Network Performance for its OpCos across the Middle East and Africa

Huawei transformed this customer's legacy system into a centralized private OSS cloud system. Thanks to Huawei's extensive global experience and use cases, OSSaaS has helped the customer increase operating efficiency, reduce CAPEX and OPEX, and shorten its transformation cycle to less than 12 months.

According to the customer, "Creating

a unique user experience is our main goal, so we continually improve network performance quality, and seek the best partners. Huawei is a trusted strategic partner, and we're delighted to expand our scope of cooperation from purely telecoms to IT. Huawei's holistic OSSaaS solution perfectly suits our requirements."

## What more can be done

Huawei's OSSaaS is a centralized solution designed to reduce TCO for CSPs. It provides end-to-end service level management to help improve network performance, and offers a developer environment for CSPs to develop use cases on the OSS platform. The OSS platform can therefore be flexibly used to provide more services.

OSSaaS follows service-driven principles, and can easily provide CSPs with new capabilities. Thus, it's a next-gen OSS – an IES that's perfect for transformation and giving CSPs the new skills, processes, and features necessary for OSS transformation.

These include deploying DevOps methods for service development and operations; on-going integration of system-oriented architecture (SOA) for the OSS/BSS and IT management system; on-going integration of existing and virtual service operations to fully utilize common, virtualized ICT architecture; and acquiring enterprise architect and development skills.

Huawei's unique next-gen OSS is the first solution to support large-scale OSSaaS service deployment. This is due to its extensive experience in cloud data center networks and managed services for large enterprises, as well as its large OSS and BSS customer base. 

# China Telecom Global: Sitting high on the public cloud

Swayed by Huawei's extensive experience in the public cloud arena, China Telecom Global (CTG) teamed up with Huawei to expand its share in the public cloud market. Targeting Chinese multinationals, the operator aims to become a data haven for Chinese companies, a data exchange center for the Asia-Pacific, and a world-class integrated IT services provider.



**Luo Linyan**  
Senior Marketing Manager, Data Center, Huawei

**H**eadquartered in Hong Kong, China Telecom Global is the international subsidiary of the China Telecom Group responsible for expanding China Telecom's international presence. Using the group's considerable resources, CTG has grown its business across the Asia Pacific region and beyond, emerging as a world-class integrated information services provider.

## CTG goes global with cloud services

The Internet age has fundamentally changed the way operators do business, and the concept of integrated services in telecommunications has changed along with it. Targeting the huge potential of the international IDC market, CTG has improved its service quality and won more customers. It has also investigated business



models in new areas, and explored potential needs in the enterprise market.

CTG's customers include Chinese multinationals, Internet companies, and multinational finance companies that want to expand internationally. One such customer is Tencent. The tech giant's global strategy is

to expand its presence in other markets, and it's invested US\$2 billion to do so. According to Tencent President Martin Lau, "We want international partners that can help us expand market share."

When it comes to international expansion, companies such as Tencent mainly worry about finding a partner that can ensure consistent services at home and abroad. These companies may also require locally tailored ICT services that consider local market and network needs and have the capability for on-demand, smooth scaling.

CTG aims to meet the requirements of these types of companies. It has set out a global development plan for the public cloud market to become an integrated ICT services company that combines Internet services, public cloud services, and telecommunications services.

Under the Nebula project, which was launched in October 2013, CTG has developed cross-border public cloud services, the first stage of which was to construct two IDCs in Hong Kong and Singapore, followed by 30 such centers across the globe.

To help complete this project, CTG needed a partner with extensive experience in operating public clouds so that it could expand into the Southeast Asian and other global markets. According to CTG's CIO, "The globalization of enterprises requires multiple cross-regional data centers with unified management. Overcoming the challenges of regional limitations and fragmented IDC is critical to the success of public cloud services and improving RoI."

Public clouds need to lower expenditure, but only large-scale ones are cost competitive. The design of global super-scale public clouds must include leading solutions, services, and innovative architecture.

## **Huawei's end-to-end solution**

In line with CTG's global services plan, Huawei provided end-to-end public cloud solutions – including consultation, planning, construction, and operations – for CTG's Nebula project.

The project aims to create a global network of public cloud sites – a nebula – to act as a data haven for Chinese companies, provide a data exchange center in the Asia-Pacific, and transform CTG into a world-class integrated IT services provider.

Today, CTG has built 17 public cloud sites, with numerous Chinese multinationals such as Haier already taking up residence.

### **Expanding its reach**

With extensive public cloud construction in all major world cities, Huawei was CTG's first-choice vendor for Nebula, where CTG's global network will enable the construction of public clouds in more than 20 countries.

The global service plan for Nebula, which has service innovation at its core, requires a global unified IT infrastructure. It will form a large-scale resource pool by bridging the whole computing, storage and network resources of multiple sites. A unified resource pool enables CTG to provide regionally consistent IT services to multinational Chinese companies.

Huawei's service network, which spans over 300 countries, helped CTG establish cloud data centers in 30 regions, including Hong Kong and Singapore, so that CTG can provide global companies with integrated services that include secure and reliable storage, management, and disaster-recovery for data.

CTG's global service centers provide self-service portals where services are publicly available, allowing internal and external customers to apply for, use, and unsubscribe to services on-demand.

The portals also enable users to calculate resources accurately, simplifying internal costing

and minimizing resource waste. Self-service portals also set different roles for users by applying different permissions control on different roles.

Users can select their own service goals via a unified portal website, and quickly deploy services and O&M systems, making the customer experience friendlier.

### **Distributed architecture for huge cost benefits**

Another challenge facing Nebula was maximizing the operational efficiency of public clouds and thus cost-effectiveness.

According to the project's director, "To construct super large-scale multinational public clouds, we needed better architecture and cost-effectiveness to compete with the leading international public cloud service providers."

Huawei employed a distributed architecture for CTG's public cloud platform based on the following features: super-scale clusters, delayering, and software-defined storage. These make the solution high-performance, highly reliable, and easy to expand.

**Super-scale clusters** cut TCO by up to 20 percent via natural advantages that improve stability, enhance resource utilization, and boost management efficiency.

**Delayering** allows system architecture to be easily expanded by better matching Nebula's service development needs in different regions.

**Software-defined storage** lowers investment in traditional external storage, cutting project CAPEX and accelerating ROI for public cloud service providers to less than three years, with profits predicted for the second year.

### **Build the ecosystem together**

Building public cloud platforms is only the first step of CTG's Nebula Project. The next

*CTG's Nebula Project is the basis of the company's expansion into the global ICT market. The public cloud services platform aims to provide customer-oriented ICT services in a way that is efficient, reliable, and green.*

and most crucial step is attracting customers. In its end-to-end public cloud solution, Huawei offers business consultation, service plans, and customized expansion policies as well as products so customers can focus on expanding market share.

Openness is vital for the public cloud because multinationals require service diversity. Nebula seeks to construct a public cloud ecosystem that contains service supermarkets where local information providers can offer products and services. This type of public cloud can provide Huawei's cloud services, telecom service products, and products and applications from dozens of third parties in a continually expanding ecosystem.

### **Efficient, reliable, green**

CTG's Nebula Project is the basis of the company's expansion into the global ICT market. The public cloud services platform aims to provide customer-oriented ICT services in a way that is efficient, reliable, and green. It has helped CTG to break into the international market, and successfully assisted more than 10 Chinese enterprise customers, including Haier, to grow.

Thanks to Huawei's distributed architecture, the solution has doubled performance and reduced TCO by 20 percent. As Huawei's public cloud solution is a heterogeneous multi-cloud platform, it improves management efficiency threefold and ensures service quality. 

# Digital BES: From supporter to enabler

The Business Enabling System (BES) is the next-gen Business Support System (BSS). Designed to help carriers go digital, the BES enables a ROADS experience, open ecosystems, and agile operations.



**Hu Caiqing**  
BES Marketing Manager, Huawei



**Dong Junjie**  
BES Marketing Expert, Huawei

## Digital BES: Why?

The digital economy has shaken up customer consumption, usage habits, and business models in the telecom industry. Customer consumption and usage habits have become internetized, increasing demand for personalization, online use, sharing, and engagement in service design and product development by carriers.

Business models are more complex and diverse. Partner ecosystems are evolving from linear value chains into value fabrics where many parties interact and collaborate, and where the line between supply side and demand side is blurred. In a value fabric, pan-customers emerge for operators. These can be partners, partners' customers, normal consumers, or normal consumers that become operators' partners.

Huawei's BES responds to these changes by helping operators to digitize and become

customer-centric. These changes are pushing operators away from a focus on network assets towards a dual-centric model where customer and network assets are equally important.

Dual-centric operations enable more precise customer marketing, a greater variety of goods, and more diverse and coordinated customer channels. Customer experience is faster and more consistent, and services like purchasing and transactions are more convenient. Dual-centric operations make it easier to give telecom capabilities to partners.

These are all critical success factors for customer-centric operations.

## What does the BES enable?

The BES includes totally reconstructed and redesigned solutions in areas such as customer and experience, products and offerings, marketing and promotions, services and transactions, and cooperation and openness.

**Customer and experience:** anticipates customer needs based on customer insights, and offers products and services that can quickly meet customer needs. The BES recommends personalized products and services to meet potential needs and create a shopping experience that's real-time, online, and on-demand.

**Products and offerings:** separates products, which are part of the production process, and offerings, which are part of the sales process. For instance, if the product was a Huawei Mate 7 Extreme Edition, the offering might be as follows:

- A Mate 7 handset for 4,188 yuan
- A 5,000-yuan package plus 2,400 yuan worth of free talk time spread over 24 months, with a monthly minimum usage stipulation of 218 yuan.

This gives rise to telecommunications offerings, digital offerings, physical offerings, and packages containing all three – as well as accompanying pricing, distribution, and availability.

**Marketing and promotions:** provides customer profiling based on big data analysis and customer segmentation for customized marketing; delivers real-time event awareness to capture customer next best actions (NBA) and next best offer (NBO) for scenario-based customer behavior analysis and prediction; and strengthens social features to leverage social sharing for word-of-mouth marketing.

**Services and transactions:** supports full-channel coordination and collaboration to enable customer information to be shared across channels, which creates consistent customer experiences and services. The BES also supports high-concurrency, high-capacity transactions such as flash sales, panic buying, and coupon

promotion events.

**Cooperation and openness:** rapidly brings in and activates partners; quickly puts products on sale; and opens up marketing, payment, billing, and other capabilities to partners to monetize telecom capabilities.

## BES: Not just a business enabler

As operators transform digitally, it's imperative that they provide more digital business and digital services to compensate for dwindling revenue from traditional services; however, it's tough to do this. Future operator business models and business needs will change, requiring their enterprise architecture and business processes to quickly adapt. Flexibility of this kind will help operators deal with uncertainties.

Increasing the flexibility and adaptability of enterprise architecture requires certain adjustments. Business logic needs to move away from fragmented, back-end decentralized IT systems.

Enterprise Operational Function Entities can be created by decoupling current BSS, OSS, and MSS systems, integrating decentralized back-end capabilities, and making these capabilities service-oriented.

To maximize flexibility, the solution also requires multi-level orchestration centers that cover business and services.

## Agile technical architecture

Designed to be agile and adaptable, BES adopts a loosely coupled structure comprising front-end, middle, and back-end layers. The front-end layer mainly includes customer

*The BES is akin to a production and assembly plant for creating standardized, reusable modules that can be flexibly assembled to make solutions for different business scenarios.*

interaction channels. The middle layer chiefly handles automated, intelligent business process orchestration. The back-end layer deals with telecommunications business operations, including customer management, product management, order management, and partner management.

BES also utilizes service-oriented architecture (SOA) for modularized capabilities and module servicization. Modules with different functions can be flexibly assembled like building blocks to form the specific business solutions operators need to respond to changing business scenarios.

Lastly, BES has a virtualized, distributed architecture that can be deployed on a cloud platform. Depending on the business volume, this architecture allows for elastic scaling, smooth capacity expansion, and auto-collapse. The system can then deal with possible large-capacity, concurrent transactions like flash sales or group buying.

## BES: A powerful range of solutions

The BES is akin to a production and assembly plant for creating standardized, reusable modules that can be flexibly assembled to make solutions for different business scenarios. It features:

- An end-to-end BES solution and a next-

gen BSS that supports operators' digital operations.

- A new-generation marketing, sales and customer service solution that supports operator internetization and digital transformation.
- A front-end solution for customer engagement, interaction, and e-commerce-style experiences.
- Product and offering definitions, packages, and pricing that accelerate the launch of products and offerings.
- Full-channel order coordination, and integrated ordering for telecommunications and non-telecommunications businesses.

## How to go from BSS to BES

There are four main pathways to evolve from traditional BSS to BES:

**Co-existence of old and new systems:** The new system is built and works in parallel to the old system; for example, a management system for new services and the ecosystem.

**Overlay:** The new system is built directly over the existing system; for instance, a front-end digital store and e-commerce platform.

**Progressive reform:** Some modules in existing systems such as the back-end order management system and product management system are gradually replaced.

**End-to-end replacement:** end-to-end front-end and back-end system replacement; for instance, the replacement of systems for customer management and revenue management.

As a huge part of Telco OS, Huawei's next-gen operations system for digital transformation, BES helps carriers transform from supporters into enablers to quickly adapt to the changes in the digital era. 



# Business growth through storage consolidation

Consolidating or renovating legacy support systems is the best way for operators to boost revenues. Carrier CIOs require sustainable development by consolidating data centers and, as part of that, storage.



**Li Wuxian**  
Marketing Manager, Carrier Storage Solution, Huawei

**T**he rise of mobile Internet has seen traditional services like voice decline, which has in turn affected operators' revenues because they rely on such services. Operators must therefore think out of box to increase revenue and reduce expenditure.

They need to develop new services, understand customers, and provide

excellent digital services. They must abandon traditional voice-based revenue models, and transform IT systems from costs centers into profit centers.

Reducing expenditure needs new technology that allows operators to consolidate or renovate internal IT resources, lower OPEX, and sustain growth.

## Consolidate to accumulate

Many issues affect operators' storage systems, requiring them to consolidate storage to improve resource utilization and reduce costs.

Consolidating or renovating existing support systems is the best way to drive up revenue. For example, the data center

consolidation programs of the US and Australian governments will help them save US\$5 billion and US\$1 billion respectively. Carrier CIOs require sustainable development by consolidating data centers and, as part of that, storage.

Operators' IT support systems, which support billing, sales, pricing, network management, and other core services, have traditionally been siloed, because each system uses an exclusive set of IT system resources. This has led to data silo issues, where different support systems are unable to share resources and support systems are constructed based on the highest computing and storage demands. As a result, the average utilization of system storage resources is less than 50 percent, with some not even hitting 30 percent. Low storage resource utilization directly causes high service costs.

Meanwhile, the coexistence of multiple heterogeneous storage devices requires different management platforms, complicating management and raising OPEX.

The cost of maintenance and spare parts for most equipment is very high, keeping OPEX high. Old storage devices with shaky storage performance and capacity cannot support some services or be expanded.

## What does Huawei have in store?

Operators' main operational support systems are BSS, OSS, and VAS. BSS comprises customer relationship management (CRM), billing, and business intelligence (BI) systems.

These core service systems are very demanding on service response and service continuity, and even more so on storage performance and availability. For instance, the CRM system database service is entirely RAM-based, so pressure on the OLTP service is very high, as are performance requirements. At the

million user level, 50,000+ IOPS may be needed.

Operators also need low I/O latency. China Mobile, for instance, requires query result returns in less than three seconds and storage latency of no more than 20 ms. Availability requirements must preclude data loss, and RPO for disaster recovery must be zero.

With strong expertise in BSS, OSS, and VAS systems and a keen understanding of the IT system issues operators face, Huawei continues to introduce innovative storage products and solutions in this area.

The OceanStor converged storage solution is the cornerstone of Huawei's storage consolidation solutions for telecom services. The solution offers post-warranty equipment replacement, storage centralization, and virtualization consolidation. It also uses existing equipment, helping operators implement cross-service and cross-device data flow, eliminate data silos, improve resource utilization, and reduce OPEX. Based on the lifecycle of telecom service data, the solution delivers cost- and performance-optimized data storage solutions.

## Features and benefits

OceanStor solves problems with storage equipment that's near the end of its warranty and thus cheaper to replace than repair. Out-of-warranty storage can also cause bottlenecks in performance and capacity, leaving operators unable to expand capacity to support service growth.

OceanStor offers mid-range (OceanStor 18000 V3) and high-end (OceanStor V3) replacements for old storage products in a one-to-one or one-to-many configuration. The former is suitable for supporting large-scale services, and the latter medium-scale.

The two OceanStor devices offer two to ten times the performance of other leading products, plus the reliability of fully redundant architecture. Their performance and capacity can be increased linearly,

and the two eliminate storage performance and capacity bottlenecks, boost service processing efficiency, ensure stable core services with multi-controller redundancy architecture, and reduce TCO by over 30 percent.

OceanStor also solves the siloed deployment of storage systems, a problem many operators face in their current networks. The storage systems of network services can be replaced using a one-to-many solution that enables storage centralization, eliminates siloed service data, permits data sharing, and facilitates big data-assisted analysis and decision making. Centralization improves storage resource utilization by 70 percent.

Imbued with Huawei's broad knowledge of operator service loads, OceanStor integrates different service features and coordinates with other powerful solutions, such as Huawei's tiered storage, QoS, and cache partition, to protect critical services. In addition, OceanStor cuts investment by adjusting and allocating storage resources based on dynamic changes in data value to classify and manage data. Centralization forms storage resource pools that can be added online, and new services can go online without creating a new system, greatly shortening service TTM.

Huawei also offers powerful solutions when existing storage is still within warranty but problems exist with performance, capacity constraints, and multi-vendor products.

Huawei Data Storage Systems (HDSS) features leading heterogeneous virtualization technology for taking over third-party storage without gateways,

making networking easier and less costly.

OceanStor 18000 V3 and OceanStor V3 integrate heterogeneous storage from different manufacturers on current networks into virtualized resource pools to control these devices.

HDSS products enable data migration and storage management. They apply stable architecture and leading product tech to virtualize third-party storage on current networks, and create virtualized resource pools for unified management and operations. Customers' initial investment is protected because performance and capacity bottlenecks are resolved and TCO and management difficulties are reduced.

Storage consolidation requires leading product technology and the support of a data migration service guarantee. As a leading storage vendor, Huawei provides high-quality and efficient data migration services for customers, including online and offline migration solutions depending on service downtime requirements.

Huawei's converged storage products are compatible with over 100 types of equipment from mainstream storage vendors, and can access their virtual gateways. In addition, Huawei has extensive experience in data migration, having managed the critical service migration projects of over 50 operators globally, including high-end storage products from vendors like EMC, IBM, HDS, HP, and Sun.

Notably, HDSS heterogeneous virtualization performs migration twice as quickly as traditional gateway methods. In two-node cluster single array system scenarios, the migration time is less than three hours, 50 percent lower than that of

competitors'. This meets operators' core demands for data migration with reduced or zero interruption of critical services and minimal interruption of non-critical services.

## Keeping growth sustainable

HDSS keeps pace with the latest development trends in storage technology, with Huawei regularly releasing new products to meet operators' needs.

Huawei's storage consolidation solutions consolidate operators' current storage resources, enabling cross-device and cross-system data flow and data sharing for big data mining. Consolidation simplifies storage management, helping customers reduce management, operations, and expansion costs; accelerate service TTM; and achieve sustainable business growth.

Huawei assisted VIVACOM, Bulgaria's largest operator, to consolidate its storage. The scheme involved replacing storage systems on VIVACOM's current network, and integrating its core billing system using Huawei's high-end storage equipment, which boasts three times the performance of the legacy equipment.

Data migration involved six kinds of operating systems, two core services, and more than 50 key services, with different migration tools used for different services. Core services suffered zero interruption, and non-core services less than eight hours.

Ultimately, Huawei helped VIVACOM resolve storage performance bottlenecks and increase billing information processing efficiency by 300 percent. 

# Score a transformation win with managed IT services

*More operators are partnering with ICT service providers with primary integration capabilities and global best practices to navigate and manage the complex process of ICT transformation.*



**Zhong Qihong**  
ITO Marketing Manager, Huawei

**F**ierce competition from OTT players means operators risk becoming mere channels. To reduce costs, increase service agility, develop new digital services, and acquire new revenue streams, operators must embrace new ICT technologies.

That's why more are seeking strategic partnerships with ICT service providers with primary integration experience, global best practices, and ICT transformation capabilities.

## Beyond operations

In recent years, operators have found it harder to boost revenue as traditional telecom services continue to decline. It has become imperative for them to enhance competitiveness by controlling OPEX and improving efficiency.

At the same time, managed services that only focus on cutting OPEX are no longer sufficient to help operators overcome the challenges they face. In this sense, they need more from managed

service providers.

Transformation has to go beyond operations. Operators need to overhaul their enterprise application (E/A) architecture with virtualization, software-defined technologies, and cloud computing, so they can optimize CAPEX, increase service agility or TTM, and better meet customer demand for a ROADS experience.

This kind of transformation will involve technologies from multiple vendors, which calls for market insight, an understanding of customers, and business innovation. It also requires cost control and risk management. The combination of these factors present new challenges for operators. As a result, they need strategic partners with primary integration capabilities and compatible business objectives.

A global survey by Technology Business Research of 30 operators reveals that 73 percent expect managed service providers to take on a multiplicity of complex issues during ICT transformation.

Tasks include selecting and integrating new



technologies such as NFV, SDN, and cloud data centers; implementing cloud architecture transformation while protecting current assets; managing clouds; and improving security.

Most – 60 percent – also say managed services providers should be capable of consolidating and integrating IT and networks, as well as migrating different complex systems. As NFV and SDN deployment grows in momentum, minimizing the impact of transformation on production systems through effective management has become vital.

## Transforming for success

Huawei's managed services for ICT transformation help operators manage the highly complex transformation process to achieve commercial success.

Managed services cover operational and technological transformation, and support business transformation. Customers are free

to define the service scope they require in the following categories:

**O&M transformation:** establishes service-oriented automated operations; satisfies NFV/SDN requirements on ICT integration and operations; and involves optimizing organization, processes, tools, and platforms.

**Technology transformation:** includes network infrastructure virtualization and software-defined infrastructure, data center cloudification; application transformation; and resource application, service scheduling, and allocation. Future architecture will host three clouds: telecom, support, and business.

**Business transformation:** covers Huawei's support for business transformation, including BES technology for business process optimization, including management of the following: markets, customer relationships, billing, and third-party content providers. Huawei also provides consultation services to help operators innovate business in vertical industries, build operator

*Huawei's vision is to create an open innovation alliance. We invite operators that use our services to join this alliance so they can benefit from the growth of the ecosystem.*

capabilities and platforms, and aggregate third-party applications.

Operators can acquire new revenue streams more efficiently and at a lower risk, because the Huawei business model is both flexible and competitive.

Huawei's vision is to create an open innovation alliance. We invite operators that use our services to join this alliance so they can benefit from the growth of the ecosystem.

Transformation management requires a transformation steering committee to first define mechanisms for communicating, reporting, and assessing targets. This ensures the four main transformation stages outlined below are managed and the transformation plan is executed as scheduled:

**Stage 1: Business analysis** – involves understanding customers' business vision and strategic demands; knowing the market; collecting technical, operational, and service data; and managing an expert team comprising members from different parties.

Detailed analysis will be based on industry standards (eTOM/TAM) as well as Huawei and its partners' best practices. The findings will be used for designing system architecture and planning architecture roadmaps.

**Stage 2: Transformation solution design and planning** – specifies detailed requirements and plans for centralization, virtualization, and cloudification at the infrastructure level; includes evaluating application availability, relevance, and

compatibility with the cloud at the applications level. Stage 2 also involves defining how to use a public cloud, and mapping out detailed project plans, including a phased implementation plan and acceptance criteria.

**Stage 3: Transformation implementation** – covers plans for implementing cloud infrastructure and migrating applications, including reconstructing organizational and process flows and reconfiguring tools and platforms. Commercially, it includes signing agreements with partners, and setting up the ecosystem. The transformation steering committee and various project management organizations supervise the quality of the service to ensure each stage's objectives are met, control costs, and mitigate risks.

**Stage 4: Transformation results review** – evaluates whether transformation goals are reached, and involves preparing for the next cycle.

## Three big benefits

Operations transformation based on Huawei's open integrated operational model simplifies management, thereby enabling unified multi-vendor SLA management, improving operational efficiency and quality, and promoting organizational change.

Technology transformation based on Huawei's open cloud technology maximizes IT potential to accelerate innovation, meet diverse customer needs, and enhance the customer experience.

Business transformation support based on Huawei's open alliance integrates operators into the digital service ecosystem, aggregates multiple partners' services, enables low-risk and rapid entry to market, and secures continuous revenue streams. 

# FusionInsight: Big results from big data

To build capabilities for big data, operators are shifting focus from infrastructure to application-based operations. They're looking to enable business, build platforms, and establish big data ecosystems to unleash the value of huge volumes of data.



**Gu Xiaozhu**  
Senior Marketing Manager, Operation Transformation  
Marketing Dept., Huawei

## Mining data mountains for gold

Operators amass huge amounts of data from huge amounts of customers. Yet they don't fully exploit this unmined gold from millions of people. In the telecoms sector, the market value of big data analytics is growing - Heavy Reading predicted an increase of 26 percent year-on-year to hit US\$3 billion in 2015.

What is big data? How do we define it specifically in relation to operators?

1) It uses processing technology such as intelligent storage, intelligent data mining, and intelligent analysis to extract commercially valuable information. From the huge amounts of scattered and fragmented data that operators possess, the resulting information is applied to industry-specific applications. Operators can use it to make more informed judgments about trends, perform precision marketing, and optimize how they do business.

2) It requires a sufficiently large amount of data – normally at the PB (petabyte) level. Macro-level patterns can only be analyzed from micro-level data



*Huawei's big data solution utilizes layered architecture, the core of which is the FusionInsight platform and its two layers: data platform and data service.*

in sufficiently large quantities and collected over a long enough time span.

3) Big data technology is fundamentally different to traditional data mining technology. They differ in terms of data types, processing mechanisms, and processing speeds.

4) Applying big data will increase the productivity of society and change peoples' lives with user-centric approaches.

## Big data is driving transformation

More carriers use big data to drive business transformation like network evolution, Internetizing the user experience, and satisfying diverse, personalized user demands. They're also using it to out-compete OTT and MVNO players, innovate services, and find new revenue streams.

A real-world example includes AT&T. The American giant predicted and prevented potential churners by collecting and analyzing data from different fields and taking preventive measures, increasing retention by 36 percent.

Equally, Vodafone used big data to optimize network KPIs, reduce complaint rates, and lower CAPEX for capacity expansion, while Telefonica applied big data to grow and monetize its digital services.

In terms of building big data capabilities, operators still have a long way to go. So, they're looking away from infrastructure and toward application-based operations. Key features

are enabling business, building platforms, and establishing big data ecosystems, with the aim of maximizing the business value of big data.

## Hi, I'm FusionInsight

Huawei's big data solution FusionInsight is the culmination of Huawei's ICT and big data knowledge coupled with its understanding of operators' pain points. These include finding ways to use big data to know what users want so they can deliver it and better manage demand. Another is competing in a saturated market with rivals who are winning new users and encroaching upon their customer base at a worrying rate. Operators also need to maximize the potential value of their digital services and find new business models and profit sources.

Huawei's big data solution utilizes layered architecture, the core of which is the FusionInsight platform and its two layers: data platform and data service.

The platform layer hosts cross-field data, and the service layer supports applications. It delivers the following technical solutions for operators: efficient storage and processing, an integrated data platform, real-time streaming technology, E2E scenario modeling, innovative data monetization, and unified data operations and management.

## Basic infrastructure

Huawei's enterprise-class infrastructure for big data is unified, and centrally manages data assets from different subsystems. This resolves issues such as repeated data collection by traditional siloed IT systems, fragmented storage, and high construction costs. The solution offers a low-cost, high-performance solution that meets the challenges of massive data. In 2014, it turned a profit in the storage market in China, and in Q4 was the fastest

growing solution in the global storage market.

### Data platform layer

The data platform layer meets requirements for data convergence and real-time processing, and also efficient, low-cost data collection, conversion, storage, and processing.

Its functions are as follows:

- Scheduling cross-Hadoop cluster tasks on more than 100 large-scale clusters and unstructured files.
- Dynamic upgrading to double the performance of ETL processing.
- Accessing Hadoop components via Kerberos for data security.
- Improving performance by increasing upload efficiency in masses of small files,

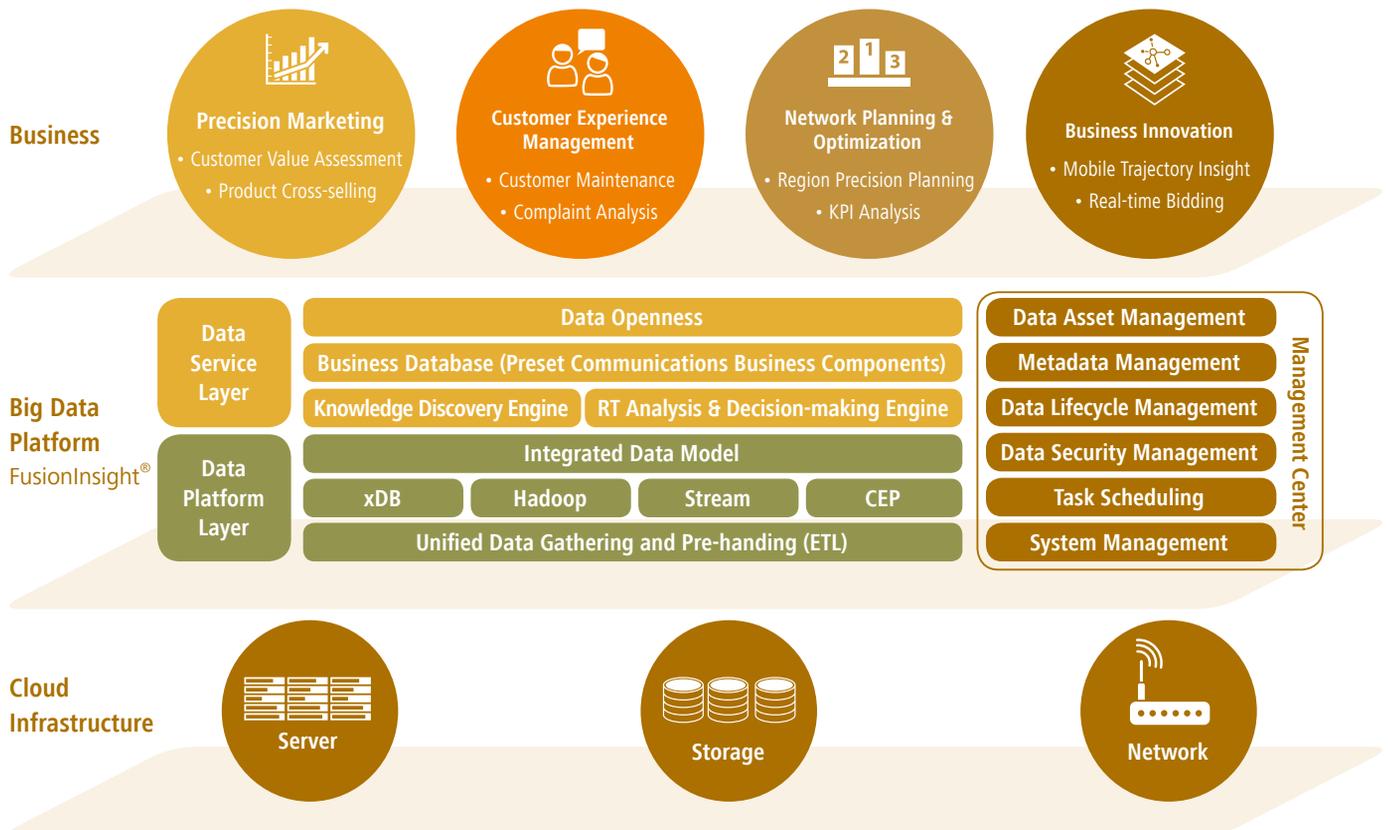
with 100,000-flow scheduling latency in less than 30 seconds.

- Providing API interfaces for flow configuration and execution for external services.

### Data service layer

The data service layer includes cross-field, full-feature analysis such as in-depth service modeling, propensity forecasting, theme extraction, character profiling, relationship estimation, characteristic analysis, and automatic feature construction.

It also incorporates advanced streamlined algorithms from Huawei, and the modeling library from its Noah's Ark Lab. These functions provide powerful support for operators to build big data modeling capabilities.



*Huawei delivers end-to-end big data solutions. It has all-round strengths in consulting, services, hardware and software, and integration, which assists operators to rapidly implement suitable big data applications to achieve business and operational transformation.*

The data service layer is rich with outstanding features:

- Cross-field analysis, BOM full-feature analysis and modeling, support for 1,000+ user characteristics, which will soon scale up to 10,000+.
- HiGraph modeling algorithm developed by Huawei, which is three to five times faster than MLlib and has an average AUC accuracy of 75 percent.
- Openness and seamless connection in R programming language.
- Automated modeling, character selection, algorithm optimization, and derivative closing.
- Reduced modeling times from 2 hours to 10 minutes.

### Application layer

The application layer of the FusionInsight platform can construct service-oriented applications decoupled from the data layer. These include precision marketing, user experience management, higher network efficiency, data monetization, and other external monetization applications.

The application layer offers the following features:

- Full cross-layer security management from L2 data collection and conversion to L4 external cooperation.
- Full privacy protection, authenticated

access based on login identity, and user data management based on user groups and irreversible encryption.

- Various ways to empower data openness.
- Easy to use third-party development environment that supports the rapid, low-cost development of third-party applications.

### Control center

The big data platform control center manages data assets, data security, work scheduling, and operations so operators can unify how they use big data.

## Interlinked big data service capabilities

Huawei delivers end-to-end big data solutions. It has all-round strengths in consulting, services, hardware and software, and integration, which helps operators to rapidly implement suitable big data applications to achieve business and operational transformation.

Huawei's R&D centers span the globe. Our services are interlinked and we provide end-to-end service solutions from initial scenario analysis to business modeling and training in modeling. We help operators build big data capabilities.

For Indonesian carrier PLDT, we delivered a solution comprising big data collection, convergence, and big data infrastructure, which cut hardware costs by 50 percent and boosted ETL capabilities by 30 percent.

For China Unicom Shanghai, we built a big data ecosystem to help create its monetization business model, generating 10 million yuan (US\$1.54 million) in revenue for the operator in 2015.

Huawei bases its solution on fully understanding operators and how to best extract gold from data. 

# Powerful data centers Cloudification with the Huawei SD-DC<sup>2</sup>

*Huawei's powerful cloud data center solution helps operators cloudify their data centers so that their IT infrastructure can meet the needs of the cloud era. The solution delivers integrated, end-to-end, full-tier data center architecture that creates value for customers through continuous innovation and collaboration.*



**Yang Hao**  
Senior Marketing Manager, Data Center, Huawei

**W**e stand on the cusp of change in the ICT industry. Traditional IT is being replaced, and new ICT capabilities are set to become the core driver of change.

## The cloud computing era

We're now in a cloud computing era where data centers are increasingly important. ICT is transitioning from the second platform to the third platform. New technologies such as cloud computing, big data, mobility, and social media are accelerating ICT transformation and driving data centers to scale up, including those delivering internal services and external services.

Clouds – private, public, and hybrid – depend on data center architectures that are accessible, reliable, and flexible. Clouds

also require fast deployment, flexible scaling, high density, energy-saving capabilities, and intelligent management.

## SD-DC<sup>2</sup>



*Huawei uses distributed cloud architecture to integrate the computing, storage, and network resources of multiple data centers to form a large unified resource pool.*

Huawei's cloud data center solution is based on SD-DC<sup>2</sup> architecture with hardware and software layers. The hardware layer comprises servers, storage, and networking equipment. Based on its extensive experience in chip and hardware design, Huawei offers three powerful hardware solutions for multiple scenarios:

### **Scale-up: superior performance**

Ordinary application requirements are satisfied by Huawei's mainstream servers and storage devices. But, for core application systems such as databases that require optimal computing and storage performance, Huawei provides the high-end server RH5885 and the high-end storage device OceanStor 18000.

### **Scale-out: powerful expansion**

The design and architecture of traditional servers and storage hardware no longer meet the requirements of many Internet-era applications. Unlike traditional mini-computer applications, they feature distributed architecture and large data processing and storage volumes.

This is why Huawei has developed servers and storage with distributed multi-node architecture that support smooth expansion – such as the X8000 high-density rack server and the OceanStor 9000 mass storage.

### **Convergence for simplicity**

Traditional loose coupling architecture is unsuitable for applications that need to process

large amounts of user data quickly, and that require high data processing and throughput capabilities. This is because of insufficient processing bandwidth and latency issues, which affect scenarios like big data analytics applications.

Huawei solves these problems with the E9000 Converged Infrastructure Blade Server, a solution based on our experience in computing, storage, and networking.

At the software layer, Huawei provides the FusionSphere operating system and ManageOne unified management system, which is based on OpenStack – an open, compatible software platform that provides standardized access.

The system targets global operators with multi-regional business models. Huawei uses distributed cloud architecture to integrate the computing, storage, and network resources of multiple data centers to form a large unified resource pool.

Resources are allocated by service in virtual data center (VDC) mode. The cloudified resource pool is transformed into a Data Center-as-a-Service (DCaaS) service center, providing carriers with unified resource management and scheduling. The software layer's powerful capabilities are as follows:

### **Computing virtualization**

Offers seamless connection to the OpenStack Nova service with Huawei's enhanced keyboard, video, and mouse (KVM) switch virtualization engine, thus expanding high-level virtualization features. These include virtual machine (VM) affinity scheduling and VM live migration. Capabilities include million-level VM deployment to ensure limitless cloud resource pool expansion.

### **Software-defined storage**

Offers seamless connection to the OpenStack Cinder service through the Huawei distributed storage engine. Capabilities include a maximum of

128 physical servers in a single cluster and IOPS at three to five times traditional SAN/NAS storage.

### Software-defined network

Provides programmable data center switches, virtual switches, virtual service gateways, a VxLAN channel, and SDN controller technologies. These seamlessly connect to OpenStack Neutron, realizing SDN capabilities across both physical and virtual networks.

### Unified management system

Transforms the separate data center management model with four unified management functions: unified management of multiple data centers, cloud and non-cloud data centers, heterogeneous virtualization platforms, and O&M. These combine to drive up efficiency.

### Software-defined power supply and cooling

Automatically adjusts power supply and cooling based on physical device load, and performs efficient cooling using multiple natural cooling and energy-saving devices. PUE can be as low as 1.2.

## The benefits

Traditional data center construction is hampered by issues like insufficient overall hardware resource planning and uneven use of data center resources. Both problems, for example, affect the financial industry.

Demand for peak-load shifting in data centers is extremely high, with the resource occupancy of some application servers exceeding 60 percent during peaks in business, while resource occupancy of other application servers can drop to 5 percent for long periods.

Furthermore, the operation and management of IT systems during the informatization process is getting harder because of silos created by legacy system architecture, which increases equipment quantity.

Huawei's end-to-end solution for constructing cloud data centers provides users with full planning, design, product, consolidation, and migration services. It includes top-level framework planning for customers' businesses, unified delivery of equipment for shorter deployment cycles, quicker fault location, and guaranteed system compatibility.

Huawei's dual-active data center solution ensures service continuity and disaster recovery, both within data centers and between multiple cross-regional data centers.

The Active-Active design covers six layers: storage, security, database, applications, networks, and transmission. These deliver reliable and stable services at the architecture level.

The system can concurrently process services across data centers, enabling dual-active mode at the application level, while ensuring non-stop services and zero data loss. For complex applications containing both databases and files, the solution guarantees consistency between databases and files to ensure data integrity and consistency in services.

Huawei's cloud data center solution can help operators deliver data center cloudification for the cloud era. It provides integrated, end-to-end, full-tier data center architecture including storage, computing, networking, security, and data center infrastructure.

Huawei's powerful solution can help customers transform their traditional data centers into cloud data centers, and create greater value through continuous innovation and successful partnerships. 

# Getting located with Wi-Fi

New tech like millimeter wave (MMW), accurate timing, and channel state information (CSI) will soon make Wi-Fi the main tool for universal positioning, which in turn will give rise to thousands of apps for the Internet of Things (IoT).



**Liu Yongjun, Yu Xixi & Yang Hui**  
Research Planning Dept., 2012 Labs, Huawei

**A** basic human instinct is to get oriented in unfamiliar surroundings. Our early ancestors used the sun and stars to find their way, while the quadrant and sextant guided European explorers in the Age of Discovery over 500 years ago. Now we use smartphone apps to achieve the same thing: positioning.

The modern world, especially IoT, has created more scenarios where it's useful to know where things are. Factory managers expect to track materials and equipment, and fire-fighters need to find people in smoke-filled buildings. Everyone wants to locate parking spaces quickly and easily and, in malls, quickly find shops, products or curious children who have wandered off. Likewise, a smart home needs to know where its occupants are to perform even simple tasks like turning the lights on and off.

Whenever objects are connected to a network, there's a need for positioning.

## What's so great about Wi-Fi?

Recent research into IoT has covered positioning technologies such as cellular networks, satellite,

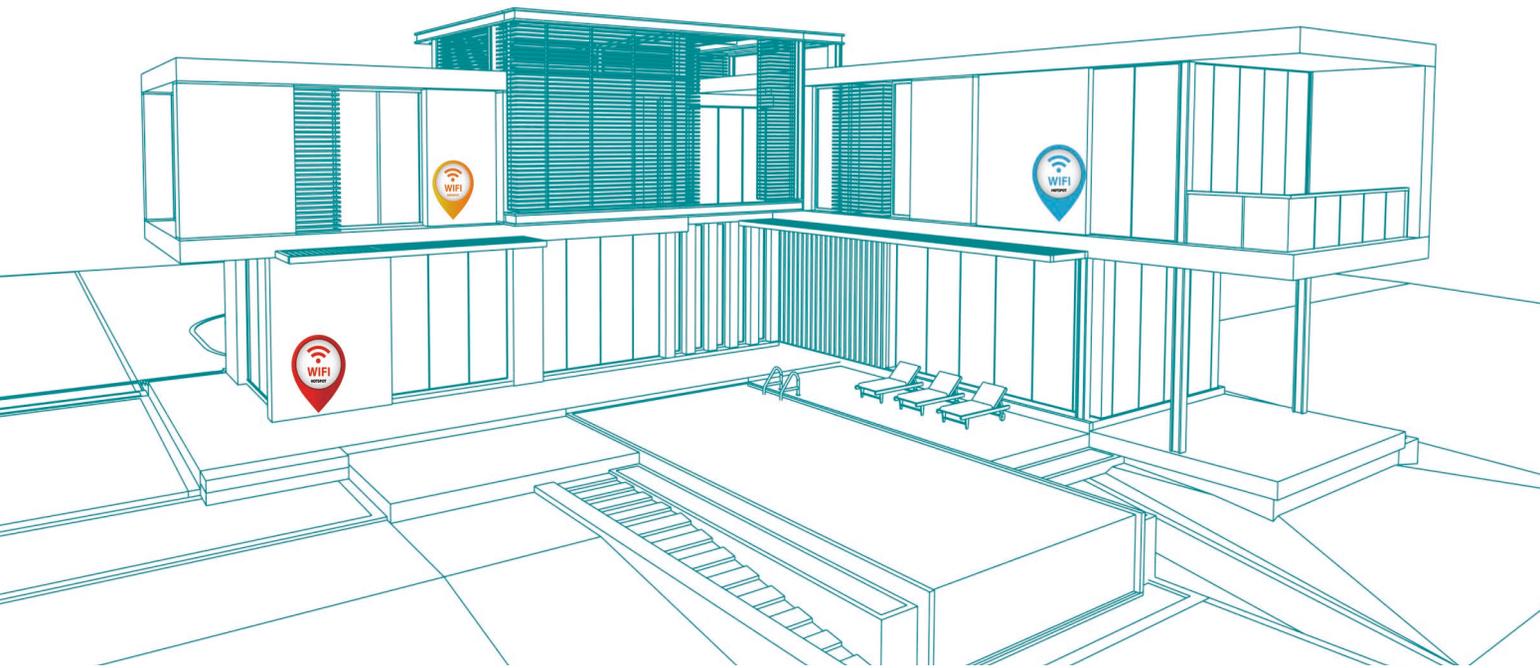
ZigBee, Bluetooth, ultra-wideband, and Wi-Fi.

However, each technology has its own disadvantages. Cellular networks are only accurate to a few hundred meters, making precision positioning impossible for IoT; satellite signals cannot be acquired indoors; and short-range wireless communications technologies like ZigBee, Bluetooth, and ultra-wideband are very scenario-specific. Moreover, ultra-wideband is too costly to popularize, the positioning accuracy of ZigBee and Bluetooth is just 5 to 10 meters, and the limited bandwidth of all three hinders widespread application.

Bandwidth is where Wi-Fi has the upper hand. Wi-Fi bandwidth is constantly increasing, and we're seeing multiple antenna technology more widely used. With higher bandwidth, timing and range resolution improves, and multiple antenna technology allows multiple angulations, significantly increasing positioning accuracy.

Wi-Fi's other advantages is its real-world commercial success in numerous sectors, which will make it easier to drive use in other scenarios.

Wi-Fi infrastructure already exists: Wi-Fi chips have long been standard in smart phones, and there's no shortage of Wi-Fi access points.



This will facilitate the commercial adoption of Wi-Fi for positioning and, as its use increases, costs will fall further.

## Indoor pain points for IoT

**Lack of a universal solution.** In malls, exhibition halls, and other crowded public places, positioning signals are vulnerable to interference and attenuation, which affects precision. Factors such as differences in the accuracy of equipment and the placement of objects in indoor locations can also cause positioning errors. These kinds of issues require complex and diverse solutions, increasing costs.

**Excessive solution maintenance costs.** Most positioning solutions are based on either ranging or fingerprinting technologies. The former requires the additional deployment of anchors and the recording of anchor positions, often necessitating a large amount of testing for channel modeling, which drives up costs.

The latter depends on the advance collection of a huge quantity of field data in regard to the positioning environment. Because fingerprint collection is difficult to automate, this frequently makes this process extremely labor-intensive.

Higher positioning accuracy means higher data maintenance costs due to the correlation between positioning precision and fingerprint collection granularity.

Even slight changes to the environment or anchors require the fingerprint database to be maintained, further increasing costs.

**Immature industry chain raises costs.** The industry chain ecosystem for positioning applications is immature, so costs are high. Today, the industry chain consists of many, uncoordinated links; for example, positioning equipment manufacturers, map management companies, overall solution integration providers, back-end application developers, and positioning service operators.

**Poor accuracy for IoT.** The current level of accuracy is insufficient, mainly because Wi-Fi was designed for communication and not positioning. The cost issues highlighted above will be resolved, so accuracy remains the major hurdle.

## Getting precise

With the rapid growth of new applications, especially IoT applications, poor positioning accuracy is a technological constraint. However, new technology may offer a solution.

**MMW band:** Millimeter waves occupy the electromagnetic frequency spectrum from 30 GHz to 300 GHz. MMW is unsuitable for long-distance wireless communication due to high attenuation and because some bands are easily absorbed by the atmosphere. However, MMW is fine for short distance communication due to its

large spectrum and the short transmission range needed in today's dense cellular networks. This is why MMW is touted as a major 5G technology.

MMW is also an IEEE 802.11 standard for next-gen 60G communications. As a result, anticipation is heavy for Wi-Fi-based MMW technology. MMW's super-high bandwidth ensures higher timing resolution, and its narrow beam and high angular resolution make it well suited for high-precision indoor positioning.

The positioning accuracy and stability of MMW can be affected by its short transmission distance, sensitivity to blocking and movement, and interference due to the lack of networking management; however, it will be possible to overcome these drawbacks when MMW is integrated with Wi-Fi technology.

**Fine Timing Measurement (FTM):** TOA/TDOA timing/ranging-based technology is another current positioning method. In theory, it can achieve high positioning accuracy, but it relies on relatively high signal bandwidth.

In the recently revised IEEE 802.11 standards that define FTM, the timing unit is 0.1 ns for use in accurate time measurements. This means that Wi-Fi technology based on this protocol through accurate timing enables ranging granularity of up to 3 cm. As the new standards evolve over time, more accurate timing measurement mechanisms will be considered.

**CSI:** CSI is an Orthogonal Frequency Division Multiplexing (OFDM) technology that describes the physical layer of Wi-Fi.

It provides information at the subcarrier level about amplitude and phase variation after the wireless signal undergoes spatial transmission. This creates lower-level and more stable channel information and higher spatial resolution, which leads to better positioning. CSI is not affected by signal instability that hinders the widely used

RSSI positioning method.

But, CSI technology has technical drawbacks. The ideal CSI value accurately reflects the time-frequency response of the spatial channel the signal passes through. However, it is impossible to perfectly synchronize the timing, frequency, and phase between the receiving and sending end.

Synchronization errors lead to contaminated CSI values, preventing their use as location values. Purifying CSI values is a current, promising area of focus, and lab teams have got it down to about 1 m using CSI fingerprints.

MMW and FTM Wi-Fi technologies will make centimeter-level positioning accuracy possible. No doubt, Wi-Fi will attract more interest from other sectors besides the consumer domain.

Industry and security, which have much higher requirements for positioning accuracy, are likely to be attracted to applications such as high-precision excavators for mining or pinpointing small products in large warehouses.

CSI technology will improve the accuracy of Wi-Fi positioning based on fingerprint technology to sub-meter levels for applications like locating products in supermarkets, indoor navigation, and security monitoring solutions. These sorts of applications will take user experience to new heights.

Emerging technologies will necessitate modifications to the lowest layer of Wi-Fi, which will allow the technology's potential as a high-precision positioning solution to be fully exploited.

Thanks to new MMW, accurate timing, and CSI technologies, Wi-Fi is set to become the preferred universal positioning solution. As Wi-Fi positioning technology improves, it will give rise to countless new applications for IoT. 

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